

Technology Development for Direct Fabrication of Light-Weight High-Resolution Full-Shell X-Ray Optics

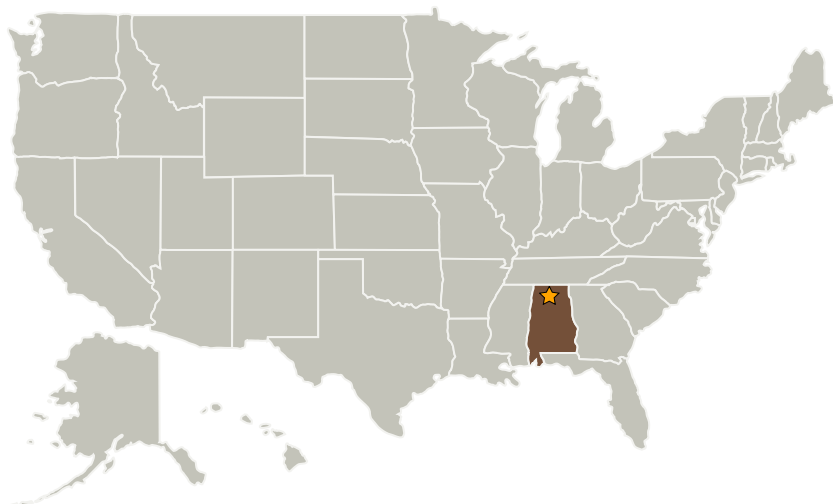
Completed Technology Project (2016 - 2019)



Project Introduction

The next generation X-ray telescopes will require the availability of technologies to fabricate high resolution, very low mass, x-ray optics. To increase the throughput of the telescopes by nesting, the mirrors need to be relatively thin, yet stiff enough to ensure the mechanical stability and high angular resolution required. A full-shell approach takes advantage of the natural stiffness of the closed geometry, so potentially very-thin-wall x-ray mirrors can be employed. Also the full-shell approach permits simpler alignment and integration, compared to segmented x-ray optics, and less massive telescope structure. We intend to develop the capability (polishing techniques, fixturing, metrology methods) for direct and efficient fabrication of Chandra-like full-shell x-ray optics, yet with over an order of magnitude lighter mirrors using a Zeeko computer-controlled 7-axis polishing machine. The techniques that will be developed will be applicable to full-shell mirrors, but can be equally applied to segmented optics. This effort will build on work done to date on fixturing, software and metrology, funded internally at MSFC. Fixturing, already designed, will be tested and used to support the thin shells in a very-low-stress manner during all aspects of fabrication. In-situ metrology will be incorporated, specifically tailored for use in conjunction with the deterministic surface figuring machine. The goal of the 3-year program is to demonstrate capability through the fabrication and x-ray testing of thin ($\sim 1.5\text{mm}$), light-weight, full mirror shells with few-arcsec angular resolution and describe a path forward to sub-arcsecond resolution.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
★ Marshall Space Flight Center (MSFC)	Lead Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations

Alabama

Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Astrophysics Research and Analysis

Project Management

Program Director:

Michael A Garcia

Program Manager:

Dominic J Benford

Principal Investigator:

Mikhail V Gubarev

Co-Investigators:

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Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **4**



Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.2 Observatories
 - └ TX08.2.1 Mirror Systems

Target Destination

Outside the Solar System